

CENTER FOR BEAM PHYSICS SEMINAR

“Limitation of Electron Beam Conditioning for FELs”

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SLAC

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Albert Ghiorso Conference Room (71-264), LBNL
●●●*Refreshments served at 10:20 AM* ●●●

Abstract: Several ideas have been proposed to “condition” an electron beam prior to the undulator of a Free-Electron Laser (FEL) by increasing each particle’s energy in proportion to the square of its transverse betatron amplitude. This conditioning enhances FEL gain by reducing the axial velocity spread within the electron bunch. We demonstrate that for symplectic beamlines, and independent of the method, this conditioning is always accompanied by a large head-tail focusing variation which, for short wavelength FELs, is so severe as to make conditioning completely impractical. We furthermore find that any system added to correct the head-tail focusing variation will also remove the conditioning. As an example, a new method for conditioning is presented and shown to result in exactly the same head-tail focussing problem as in the original paper by Sessler *et al* (PRL, 1992).

Biographical data and research interests: Paul Emma obtained his BSEE at the University of Hartford in 1987. He was with the Operations Group at FNAL during 1981-1986, and has been at SLAC since 1988, working on the SLC, NLC, and LCLS. Gennady Stupakov graduated from the Novosibirsk Institute of Nuclear Physics, doing plasma physics during what he calls “prehistoric times.” He worked at the SSC (1991-1994) studying such issues as ground motion in accelerators and beam echoes. He has been at SLAC since 1994. His current interests include impedances and wakes, beam instabilities, laser-beam interaction and, most recently, CSR-induced instabilities.